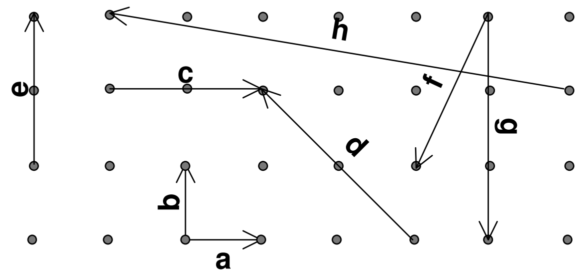
A vector is a combination of direction and magnitude. It is important to realize that it makes no difference where we draw the vector; if it has the same magnitude and direction *it is the same vector*.

This can be used in geometric situations. For example, consider parallelogram ABCD. (Draw and label a parallelogram now.) Let **a** = $\overrightarrow{\mathbf{AB}}$ and **b** = $\overrightarrow{\mathbf{BC}}$. Now side CD is the same length and parallel to side AB so it must also be true that $\overrightarrow{\mathbf{DC}} = \mathbf{a}$ and similarly $\overrightarrow{\mathbf{AD}} = \mathbf{b}$. Now consider the diagonals as vectors. $\overrightarrow{\mathbf{AC}}$ can be written as a vector addition $\overrightarrow{\mathbf{AC}} = \overrightarrow{\mathbf{AB}} + \overrightarrow{\mathbf{BC}} = \mathbf{a} + \mathbf{b}$. This is just adding vectors head to tail. Similarly the other diagonal $\overrightarrow{\mathbf{BD}} = \overrightarrow{\mathbf{BC}} + \overrightarrow{\mathbf{CD}} = \overrightarrow{\mathbf{BC}} - \overrightarrow{\mathbf{DC}} = \mathbf{b} - \mathbf{a}$.

1. Write the other vectors in terms of **a** and **b.**



   a. **c** =
   b. **d** =
   c. **e** =
   d. **f** =
   e. **g**=
   f. **h**=
2. Now write the other vectors in terms of **e** and **f**.
   a. **a** =
   b. **b** =
   c. **c** =
   d. **d** =
   e. **g**=
   f. **h**=
3. Now write the other vectors in terms of **g** and **h**.
   a. **a** =
   b. **b** =
   c. **c** =
   d. **d** =
   e. **e**=
   f. **f**=
4. OABC is a trapezium with AB parallel to OC and 3AB=2OC. $\mathbf{a} = \overrightarrow{\mathrm{OA}}$ and $\mathbf{c} = \overrightarrow{\mathrm{OC}}$. Point D divides BC internally in the ratio 1:2.
   a. Show this information on a clearly labelled diagram.
   b. Write $\overrightarrow{\mathrm{OB}}$ in terms of **a** and **c**.
   c. Write $\overrightarrow{\mathrm{AC}}$ in terms of **a** and **c**.

   d. Write $\overrightarrow{\mathrm{CB}}$ in terms of **a** and **c**.
   e. Write $\overrightarrow{\mathrm{CD}}$ in terms of **a** and **c**.
   f. Write $\overrightarrow{\mathrm{OD}}$ in terms of **a** and **c**.
   g. Write $\overrightarrow{\mathrm{AD}}$ in terms of **a** and **c**.
5. In quadrilateral OABC, $\mathbf{a} = \overrightarrow{\mathrm{OA}}$ and $\mathbf{c} = \overrightarrow{\mathrm{OC}}$. None of the angles can be assumed to be right angles. Vectors **a** and **c** are equal in magnitude. Sketch and classify the quadrilateral if
   a. $\overrightarrow{\mathrm{OB}} = \mathbf{a} + \mathbf{c}$
   b. $\overrightarrow{\mathrm{OB}} = 2\mathbf{a} + \mathbf{c}$
   c. $\overrightarrow{\mathrm{OB}} = 2\mathbf{a} + 2\mathbf{c}$
   d. $\overrightarrow{\mathrm{AB}} = \mathbf{a} + 2\mathbf{c}$
   e. $\overrightarrow{\mathrm{AB}} = 3\mathbf{c} - 2\mathbf{a}$
   f. $\overrightarrow{\mathrm{AB}} = -2\mathbf{a} - \mathbf{c}$
   g. $\mathbf{c} = 3\overrightarrow{\mathrm{AB}}$
6. In heptagon ABCDEFG $\mathbf{a} = \overrightarrow{\mathrm{AB}}$ and $\mathbf{c} = \overrightarrow{\mathrm{BC}}$ are perpendicular unit vectors. $\overrightarrow{\mathrm{BD}} = 0.2\mathbf{a} + \mathbf{c}.$ $\overrightarrow{\mathrm{AE}} = 0.5\mathbf{a} + 2\mathbf{c}.$ $\overrightarrow{\mathrm{FD}} = 1.4\mathbf{a}.$ $\overrightarrow{\mathrm{EG}} = -0.5\mathbf{a} - \mathbf{c}.$ Draw ABCDEFG accurately to scale.